



Prevalence and risk factors of trichomoniasis in patients attending two medical centres in urban and rural areas in the North West Region, Cameroon

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ABSTRACT

Trichomoniasis has been increasingly recognised over the past decade, underlining its importance as a public health problem. This study aimed to determine the prevalence and risk factors of trichomoniasis in patients in urban and rural areas in the NW Region, Cameroon. Three hundred and forty-four samples, were gotten from the vagina and urethra using sterile swabs. Wet mount microscopy, sedimentation concentration technique and staining were used to observe collected samples. Risk factors were assessed via questionnaires. Data obtained was analyzed using SPSS version 21. Chi square test was used to test for differences in proportions in different categories, regression analysis was used to test the relationship between prevalence and risk factors in the study. The overall prevalence of trichomoniasis was 16.3% (56) and prevalence was higher in the urban area 20.9% (36) than in the rural area 11.6% (20). Females were more infected 19.8% (51) than males 5.8% (5), singles had a higher prevalence 18.6% (22) compared to those married 15.9% (34). The risk factors of interest included; having multiple sexual partners, no use of condoms during sex, and lack of hygiene. Trichomoniasis prevalence in the study was high (16.3%) indicating the need for more sensitization. Rural areas are not free from this infection and also merit extra preventive and treatment efforts.

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INTRODUCTION

Trichomoniasis is a sexually transmitted disease (STD) caused by an extracellular flagellated parasitic protozoan *Trichomonas vaginalis* which adapts to live in anaerobic conditions (Al-Majidii and Alsaady,

2020). The parasite spreads in all parts of the world, and the prevalence of trichomoniasis in women is higher than in men (Nouraddin and Alsakee, 2015). It is an obligate parasite, and humans are the only known hosts (Riestra et al., 2019). *Trichomonas vaginalis* can exist in

an individual's body together with other microorganisms. Some of them include: *Gardnerella vaginalis*, *Bacteriodes fragilis*, *Mobilincus* and *Candida albicans* (Takang et al., 2022).

Trichomoniasis has an estimated annual incidence of 276.4 million cases globally and about 30 million cases in sub-Saharan Africa (Donbraye et al., 2010). In Cameroon, there have been few previous reports about the frequency of trichomoniasis, the prevalence of trichomoniasis has been reported to be 17-20% (Buve et al., 2001). Nearly half of all women with *Trichomonas vaginalis* are asymptomatic but signs of infection in symptomatic women include malodorous vaginal discharge, oedema or erythema and strawberry cervix (haemorrhagic lesions), vulvar irritation and inflammation. Other complaints include dysuria, pruritus, dyspareunia and lower abdominal pain (Donbraye et al., 2010, Olusegun-Joseph and Killaney, 2016).

Trichomoniasis has been found to be associated with various health complications including Pelvic Inflammatory Disease (PID), significant pregnancy complications, cervical cancer, prostatitis, infertility and the acquisition of Human Immune Deficiency virus (HIV) (Mabaso and Abbai, 2021). Incidence rates can vary according to factors like older age, sexual activity, number of sexual partners, co-infection with other STDs, phase of the menstrual cycle, methods of diagnosis, and socio-economic status (Piotr et al., 2020).

Trichomoniasis is not a reportable infection, despite its high impact on public health, so data regarding diffusion of *Trichomonas vaginalis* are scarce and incomplete in most countries. In many cases, especially in asymptomatic patients, the infection is not recognized and its prevalence is therefore generally underestimated. Until now, only a limited number of epidemiological investigations describing the prevalence of *Trichomonas* infection in the North West Region of Cameroon have been reported in literature, which focused only on pregnant women (Takang et al., 2022).

Despite the estimated large burden of trichomoniasis in the African regions, there is a paucity of data available for the current prevalence, frequency, clinical presentation, demographic and risk factors of trichomoniasis in Cameroon affecting both females and males. Therefore, this study will provide relevant data to fill the gap of the prevalence and associated risk factors of trichomoniasis among men and women attending two medical facilities in North West Region of Cameroon.

Also, much is not known about the disease in the rural area but for the transmission route. Reproductive health providers often think about STDs in general as a metropolitan problem. Several factors might lead these public health officials and providers to underestimate sexually transmitted infections (STI) risk in rural areas. One of such factors is that rural populations tend to be older. Relatively few people live in these areas, and it can be harder to obtain data on their risk behaviours, (Jenkins et al., 2021). In addition, it is grossly underreported in men who can act as reservoirs for the continuous transmission to women (WHO, 2011).

Trichomonas vaginalis (TV) has been increasingly recognized over the past decade, underlining the importance of this pathogen as a public health problem (Poole and McClelland, 2013). The disease is mainly asymptomatic in men; hence the objectives of this study were to enrol both men and women in an urban and rural area to determine the prevalence and risk factors which predispose participants in order for preventive and treatment measures to be carried out.

MATERIALS AND METHODS

Study design and population

Three hundred and forty-four persons were enrolled in this cross-sectional study, 86 were males and 258 were females. One hundred and seventy-two persons were enrolled from Providence Polyclinic, which is located in Bamenda, an urban area in the North West region and 172 from Balikumbat District Hospital, which is located in a rural area in the North West region. The ages

ranged between 17 to greater than or equal to 53 years. The patients were selected randomly among men and women from the above-mentioned hospitals over a period of 6 months from February 2022 to July 2022.

Ethical considerations

This study was approved by the research ethics committee of the Faculty of Health Sciences, of The University of Bamenda approved the study (2022/0691H/UBa/IRB). All men and women were given consent forms and questionnaires before collecting urethra and vagina swabs, respectively with assistance from the laboratory technicians in the two hospitals. The questionnaire included information of the patients: age, gender, marital status, occupation, level of education, household size, monthly salary and religion.

Inclusion criteria

Anybody who attended either of the two health facilities and consented to participate, and in the prescribed age range, was included in the study.

Non-inclusion criteria

Anybody who did not attend any of the two health facilities, and did not consent to participate, or below the minimum age of 17 years or was under treatment with metronidazole was excluded from the study.

Estimation of sample size

The population sample size was estimated using the population sample size formula (Naing et al., 2006).

$$n = \frac{z^2 pq}{d^2}$$

Where n = sample size,

Z = Z statistic for a level of confidence

p = expected prevalence or proportion. The estimated prevalence of trichomoniasis in South African women aged 15-24 years ranges from 3.1% to 20% (Francis et al., 2018). Prevalence rate of trichomoniasis were 15.3%, 20.0% and 20.2% as reported by Moodley et al. (2015), De Waaij et al. (2017) and Morikawa et al. (2018) among South

African women. In Cameroon, the prevalence of trichomoniasis has been reported to be 17.6%-20% in women attending the Yaounde Teaching Hospital (Buve et al., 2001).

q = 1-p,

d = precision at 5%

$$(p) = \frac{3.1+15.3+ 20.0}{3} = 0.128,$$

(q) = 1-p (0.872), standard error (z) = 1.96, error margin (d) = 0.05

$$\text{Sample size (n)} = \frac{1.96^2(0.128)(0.872)}{(0.05)^2}$$

n = 172 participants

The study involved a population size of 172 participants from each of the hospitals in the urban and rural area, making 344 participants in total.

Assessment of risk factors

Risk factors were assessed using a structured questionnaire written in English to get demographic information about the participants. Patient medical history (past STD history and past diagnosis history) was also included in the questionnaire. The questions were read to individuals who could not read and write. Also, the information on the questionnaire was explained to those who did not understand the questions.

Vaginal or urethral smear collection

Gloves were worn, the collection bed was cleaned with ‘‘l'eau de javel and the gloves discarded. Another pair of gloves were worn and the patient was asked to lie on the bed if it was a female or sit on the bed if it was a male, then a sterile swab was inserted into the vagina or urethra of the patient and rotated in the clock wise direction. The swab was placed in the Aimes transport medium and taken to the Parasitology unit of Providence Polyclinic and Balikumbat District Hospital, respectively for examination (Takang et al., 2022).

Sample analysis

Three methods were used for diagnosis namely; wet mount, sedimentation concentration technique, and staining of vaginal smears (VS) and urethral smears (US).

According to Piotr et al. (2019), after the VS or US was collected two drops of normal saline were put on a clean slide and VS or US was mixed using the swab on the portion of the slide containing the normal saline. The slide portion containing the smear was covered with a cover slip and observed under the 10X and 40X objective of the light microscope. *Trichomonas vaginalis* was identified by movement with its flagella, its colour (transparent), and its axostyle under 10X and 40X objective of the light microscope.

For the sedimentation concentration technique, according to Cheesbrough (2009), twenty drops of normal saline were added to the swab tube and mixed. The mixture was put in a clean test tube and centrifuged at 1000 revolutions per minute for 1 minute. The supernatant was decanted and the sediment was put on a clean slide. The slide was covered with a cover slip and observed under the 10X and 40X objective of the light microscope. This technique was done for negative wet mount slides.

Staining of the smear for negative samples was done according to Cheesbrough (2009), after the VS or US was smeared on a clean slide and allowed to air dry. The slide was put on a staining rack and gently flooded with three drops of 10% Giemsa stain, the slide was allowed to stain for ten minutes, washed with clean water gently and air-dried. One drop of oil immersion was dropped on the slide area of the smear and observed under the 100X objective of the light microscope.

Statistical analysis

Data collected were entered into Excel and analyzed using IBM SPSS version 2021. Proportions were calculated and the Chi square test was used to test for differences in various variables such as age, gender, level of education, marital status, occupation and number of persons per household. Regression and correlation tests were used to check for the significance between risk factors and prevalence in the study. Data was displayed in form of contingency tables. The probability level was set at $p < 0.05$.

RESULTS

Demographic characteristics of respondents

A total number of 344 respondents were examined during the study. The age group 17-25 years had the highest number 153 (44.5%) of respondents while the age group ≥ 53 years had the lowest number 18 (5.2%) of respondents. Majority was females 258 (75%) and males were 86 (25%). Most of the respondents were married 214 (62.2%) and only 1 (0.3%) was divorced. Most of the participants were self-employed 205 (59.6%) and the least were sex workers 5 (1.5%).

At the Providence Polyclinic (urban), the age group 17-25 years had the highest number 74 (43.0%) of respondents while the age group 44-52 years had the same number of respondents as the age group ≥ 53 16 (9.3%). Majority of the patients there were females 131 (76.2%) and males were 41 (23.8%), most of the respondents were married 93 (54.1%) and very few 1 (0.1%) was divorced. Also, majority were self-employed 84 (48.8%) and the least were sex workers 4 (2.3%) as seen in Table 1.

At the Balikumbat District Hospital (rural), the age group 17-25 years had the highest number 79 (45.9%) of respondents while the age group ≥ 53 2 (1.2%) years had the lowest number of respondents. Most of the patients there were females 127 (73.8%) and males were 45 (26.2%), majority of the respondents were married 121 (70.3%) and none 0 (0.1%) was divorced. However, majority was self-employed 121 (70.3%) and the least were sex workers 1 (0.6%) as seen in Table 2.

Prevalence of trichomoniasis

Overall prevalence of trichomoniasis in the study population

The overall prevalence of the disease was 16.3% (56), with females having the highest prevalence 19.8% (51) and males having the lowest prevalence 5.8% (5). The variation in prevalence with respect to gender was at a p value of 0.02 as shown in Table 3.

Prevalence of trichomoniasis with respect to gender in the different hospitals

The prevalence of the disease in males at Providence Polyclinic (urban) was higher 7.3% (3) than those at Balikumbat (rural) 4.4% (2). Pregnant females 6.6% (2) and non-pregnant females 30.7% (31) in the urban area were more infected than those in the rural area, pregnant females 5.2% (4) and non-pregnant females 28.0% (14). The prevalence with respect to gender varied in the two hospitals and the p values were 0.01 and 0.08 at Providence Polyclinic and Balikumbat respectively, as shown in Table 4.

Prevalence of trichomoniasis with respect to age in the different medical facilities

The age group 17-25 had the highest prevalence 19.6% (30) while the age group 44-52 years had no infected persons 0% (0). The prevalence varied differently in the different areas with p values 0.03 and 0.75 at Providence Polyclinic and Balikumbat, respectively as shown in Table 5.

Prevalence of trichomoniasis with respect to level of education in the different clinics

Those who were illiterate were more infected 31.4% (11) whereas, those at the primary level were less infected 12.9% (8). The prevalence of the disease did not vary significantly ($p=0.80$) in Providence Polyclinic (urban) whereas the variation was significant ($p=0.006$) in Balikumbat (rural), as seen in Table 6.

Prevalence of trichomoniasis with respect to marital status in the different health facilities

According to the study, singles had the highest prevalence 18.6% (22) while the married had the lowest prevalence 15.9% (34). Men who were married had the highest prevalence 7.7% (3) than the men who were not married 4.3% (2). Women who were not married had the highest prevalence 26.7% (20) than those who were married 16.9% (31). There was no variation with respect to marital status in the different locations as the p values were 0.81 and 0.87 in Providence Polyclinic and Balikumbat, respectively as seen in Table 7.

Prevalence of trichomoniasis with respect to occupation in the two hospitals

Participants who were sex workers had the highest prevalence 40% (2) while those who worked in offices had the lowest prevalence 13.3% (4). The variation was very little in the two hospitals with p values 0.08 and 0.07 at Providence Polyclinic (urban) and Balikumbat Hospital (rural), respectively, as seen in Table 8.

Evaluation of awareness of trichomoniasis in the study population

In the study, 217(63.1%) persons had no knowledge about trichomoniasis and 127 (36.9%) had knowledge of trichomoniasis. The level of awareness of the disease in the different locations did not vary significantly with p values of 0.61 and 0.68 at Providence Polyclinic (urban) and Balikumbat Hospital (rural), respectively, Table 9.

Relationship between trichomoniasis and risk factors

The study showed that 198 respondents rarely cleaned their toilets, while 125 of the respondents cleaned their toilets often and 21 of the respondents cleaned their toilets very often. Also, 329 persons didn't share their fomites with anyone while 15 of them shared their fomites. Again, 319 people didn't share their bathing buckets while 25 did share their bathing buckets with their partner. The risk of getting the infection was different in the different hospitals with p values of 0.01 and 0.13 in the urban and rural area, respectively as shown in Table 10.

In Table 11, 33 respondents had multiple sexual partners giving a percentage of 9.6% while the majority 311 of the correspondents didn't have multiple sexual partners giving a percentage of 90.4%. The probability of infection with respect to sexual activity varied significantly in the different hospitals giving p values of 0.00 and 0.05 in the urban and rural area, respectively.

In this study, we observed that the majority of participants 311 (90.4%) did not have multiple sexual partners while for those who had multiple sexual partners, most (17

(4.9%) of them had two sexual partners. The number of sexual partners varied in the different locations with p values 0.00 and 0.02 in the urban and rural area, respectively. The number of sexual partners per participant can be seen in Table 12.

The participants who did not have multiple sexual partners had never had sexual

activity while for the participants who had multiple sexual partners, 11 (3.2%) of them attested to have sex often while 17 (4.9%) attested to having sex rarely. The frequency of sexual activity varied in the different areas giving p values of 0.00 and 0.02 in the urban and rural area, respectively, Table 13.

Table 1: Demographic characteristics of the urban study population at Providence Polyclinic.

Characteristics	Category	Number	Percentage (%)	
Age (years)	17-25	74	43.0	
	26-34	42	24.4	
	35-43	24	14.0	
	44-52	16	9.3	
	≥53	16	9.3	
Gender	Male	41	23.8	
	Female	Pregnant	30	17.4
		Non pregnant	101	58.7
Level of education	Primary	25	14.5	
	Secondary	67	39.0	
	University	77	44.8	
	Illiterate	3	1.7	
Marital status	Married	93	54.1	
	Single	69	40.1	
	Widowed	9	5.2	
	Divorced	1	0.6	
Occupation	Student	48	27.9	
	Self employed	84	48.8	
	Professional	25	14.5	
	Sex worker	4	2.3	
	Housewife	11	6.4	
Household size (Number of persons)	1-3	56	32.6	
	4-6	76	44.2	
	7-10	39	22.7	
	> 10	1	0.6	
Monthly salary (FCFA)	Below 50, 000	70	40.7	
	101,000-200,000	57	33.1	
	101,000 200,000	32	18.6	
	201,000-500,000	13	7.6	
Religion	Christianity	158	91.9	
	Others (Islam, Pegan)	14	8.1	

Table 2: Demographic characteristics of the rural study population at Balikumbat District Hospital.

Characteristics	Options	Numbers	Percentage (%)	
Age (years)	17-25	79	45.9	
	26-34	48	27.9	
	35-43	38	22.1	
	44-52	5	2.9	
	≥53	2	1.2	
Gender	Male	45	26.2	
	Female	Pregnant	70	44.8
		Non pregnant	50	29.1
Level of education	Primary	37	21.5	
	Secondary	101	58.7	
	University	2	1.2	
	Illiterate	32	18.6	
Marital status	Married	121	70.3	
	Single	49	28.5	
	Widowed	2	1.2	
	Divorced	0	0.0	
Occupation	Student	25	14.5	
	Self employed	121	70.3	
	Professional	5	2.9	
	Sex worker	1	0.6	
	Housewife	20	11.6	
Household size (Number of persons)	1-3	23	13.4	
	4-6	93	54.1	
	7-10	55	32.0	
	> 10	1	0.6	
Monthly salary (FCFA)	Below 50, 000	68	39.5	
	101,000-200,000	88	51.2	
	101,000 200,000	11	6.4	
	201,000-500,000	5	2.9	
Religion	Christianity	151	87.8	
	Others (Islam, Pegan)	21	12.2	

Table 3: General prevalence of trichomoniasis in the study population.

Gender	Number examined	Number infected	Percentages (%)	χ^2	P value
Male	86	5	5.8	9.214	0.002
Female	258	51	19.8		
Total	344	56	16.3		

Table 7: Variation of trichomoniasis with respect to marital status in the study.

Gender	Marital status	Providence Polyclinic		Balikumbat Hospital		Overall	
		Number examined (%)	Number infected (%)	Number examined (%)	Number infected (%)	Number examined (%)	Number infected (%)
Male	Married	23 (51.1)	2 (8.7)	16 (36.4)	1 (6.3)	39 (18.2)	3 (7.7)
	Single	20 (44.5)	0 (0.0)	28 (63.6)	2 (7.1)	48 (40.7)	2 (4.3)
	Widowed	1 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (9.1)	0 (0.0)
	Divorced	1 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)
Female	Married	95 (74.2)	20 (21.1)	80 (63.0)	11 (13.8)	175(81.8)	31 (16.9)
	Single	31 (24.2)	12 (38.7)	39 (30.7)	8 (20.5)	70 (59.7)	20 (26.7)
	Widowed	2 (1.6)	0 (0.0)	8 (6.3)	0 (0.0)	10 (90.9)	0 (0.0)
	Divorced	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	Married	118 (55.1)	22 (18.6)	96 (44.9)	12 (12.5)	214 (62.2)	34 (15.9)
	Single	51 (43.2)	12 (23.5)	67 (56.7)	10 (14.9)	118 (34.3)	22 (18.6)
	Widowed	3 (27.3)	0 (0.0)	8 (72.7)	0 (0.0)	11 (3.2)	0 (0.0)
	Divorced	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	0 (0.0)

$\chi^2 = 0.96$, p value = 0.81 $\chi^2 = 0.28$, p value = 0.87

Table 8: Variation of trichomoniasis with respect to occupation in the hospitals.

Occupation	Providence Polyclinic		Balikumbat Hospital		Overall	
	Number examined (%)	Number infected (%)	Number examined (%)	Number infected (%)	Number examined (%)	Number infected (%)
Student	48 (27.9)	12 (25.0)	25 (14.5)	2 (8.0)	73 (21.2)	14 (19.2)
Self employed	84 (48.8)	17 (20.2)	121 (70.3)	14 (11.6)	205 (59.6)	31 (15.0)
Professional	25 (14.5)	4 (16.0)	5 (2.9)	0 (0.0)	30(8.7)	4 (13.3)
Sex worker	4 (2.3)	1 (25)	1 (0.6)	1 (100.0)	5 (1.5)	2 (40.0)
Housewife	11 (6.4)	2 (18.2)	20 (11.6)	3 (15.0)	31 (9.0)	5 (16.1)
Total	172 (100.0)	36 (20.9)	172 (100.0)	20 (11.6)	344 (100.0)	56 (16.3)

$\chi^2 = 8.44$, p value = 0.08 $\chi^2 = 8.80$, p value = 0.07

Table 9: Knowledge of trichomoniasis in the study area.

Questions	Responses					
	Providence Polyclinic		Balikumbat Hospital		Overall	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Do you have any knowledge on trichomoniasis?	45 (26.2)	127 (73.8)	82 (47.7)	90 (52.3)	127 (36.9)	217 (63.1)
Do you know how trichomoniasis is being transmitted?	45 (26.2)	127 (73.8)	82 (47.7)	90 (52.3)	127 (36.9)	217 (63.1)
Have you ever gone for trichomoniasis diagnosis (test)?	18 (10.5)	154 (89.5)	36 (20.9)	136 (71.9)	54 (15.7)	290 (84.3)
Has there ever been any health outreach program in your area on trichomoniasis?	0 (0.0)	172 (100.0)	0 (0.0)	172 (100.0)	0 (0.0)	344 (100.0)
According to you, is there treatment for trichomoniasis?	30 (17.4)	142 (82.6)	49 (28.5)	123 (71.5)	79 (23.0)	265 (77.0)

$\chi^2 = 0.26, p \text{ value} = 0.61$ $\chi^2 = 0.17, p \text{ value} = 0.68$

Table 10: Association of hygiene and trichomoniasis.

Questions	Responses					
	Providence Polyclinic		Balikumbat Hospital		Overall	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
How often do you clean your toilet (%)						
Rarely	85 (49.4)		113 (65.7)		198 (57.6)	
Often	70 (40.7)		55 (31.9)		125 (36.3)	
Very often	17 (9.9)		3 (1.7)		21 (6.1)	
Do you share fomites (towel, toothbrush, dresses) with anyone?	9 (5.2)	163 (94.8)	6 (3.5)	166 (96.5)	15 (4.4)	329 (95.6)
Do you bathe together in the same bucket with your partner?	20 (11.6)	152 (88.4)	5 (2.9)	167 (97.1)	21 (7.3)	319 (92.7)

$r = 0.38, p \text{ value} = 0.01$ $r = 0.22, p \text{ value} = 0.04$

Table 11: Transmission of trichomoniasis in relation to sexual activity.

Questions	Responses					
	Providence Clinic		Balikumbat Hospital		Overall	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Do you have multiple sexual partners	21 (12.3)	151 (87.7)	12 (6.9)	160 (93.1)	33 (9.6)	311 (90.4)
Do you use condoms always	24 (13.2)	148 (86.1)	6 (3.5)	166 (96.5)	30 (8.7)	314 (91.3)
$r = 0.42, p \text{ value} = 0.00$			$r = 0.31, p \text{ value} = 0.05$			

Table 12: Trichomoniasis transmission showing the number of sexual partners.

Number of sexual partners	Providence Polyclinic	Balikumbat Hospital	Overall
	Number examined (%)	Number examined (%)	Number examined (%)
0	151 (87.8)	160 (93.0)	311 (90.4)
2	11 (6.4)	6 (3.5)	17 (4.9)
3	5 (2.9)	3 (1.7)	8 (2.3)
4	1 (0.6)	2 (1.2)	3 (0.9)
Many	4 (2.3)	1 (0.60)	5 (1.5)
Total	172 (100.0)	172 (100.0)	344 (100.0)
$r = 0.51, p \text{ value} = 0.00$		$r = 0.31, p \text{ value} = 0.02$	

Table 13: Trichomoniasis occurrence based on number of times of sexual activity.

Frequency of sex with the partners?	Providence Polyclinic	Balikumbat Hospital	Overall
	Number examined (%)	Number examined (%)	Number examined (%)
Never	152 (88.4)	159 (92.4)	311 (90.4)
Rarely	10 (5.8)	7 (4.1)	17 (4.9)
Often	6 (3.5)	5 (2.9)	11 (3.2)
Very often	4 (2.3)	1 (0.6)	5 (1.5)
Total	172 (100.0)	172 (100.0)	344 (100.0)
$r = 0.57, p \text{ value} = 0.00$		$r = 0.28, p \text{ value} = 0.02$	

DISCUSSION

An overall *T. vaginalis* prevalence of 16.3% was observed among the 344 patients from both the rural and urban area. This result is in line with that of Onyido et al. (2014) who observed a prevalence of 15.0% among 100 women studied at Ekwulumili Community Anambra State, South Eastern Nigeria. The result is also higher than the observations of Gundiri and Okwosa (2005) who observed a prevalence of 3.3% among women in Kwampe Community of Plateau State Nigeria, and also that of Takang et al. (2022) who observed a *T. vaginalis* prevalence of 2.0% among pregnant women in a Regional Hospital in Cameroon. On the contrary, the result is lower than that of Ulogu et al. (2007) and Njoku et al. (2010) who observed a prevalence of 21.53% and 19.26% among the women in Nweni Community Nigeria and students of higher institutions in Nigeria, respectively. The *T. vaginalis* prevalence in the present study is far lower than that of Al-Majidii and Alsaady (2020) who observed an incident rate (IR) of 75.2% among women in Maysan Province Iraq. The rate in the present study could be attributed to lack of personal hygiene, lack of early diagnosis and treatment or as a result of the fact that since the infection is mostly asymptomatic, it takes time to be noticed.

The prevalence of trichomoniasis was higher in the urban area (20.9%) than in the rural area (11.6%), this indicated that the patients who attended Providence Polyclinic were more infected than those who attended Balikumbat Hospital. The finding agrees with the previous study of Ton Nu et al. (2015) who had a prevalence of 10.6% in the urban area and a prevalence of 4.4% in the rural area among symptomatic and asymptomatic women in Vietnam. However, the finding disagrees with that of Ali et al. (2017) who had a prevalence of 4.5% in the urban area and 33.0% in the rural area among 200 women in Iraq. More so, the prevalence that was gotten in the present study is lower than that of Taher and Shaker (2018) who had prevalence of 29.8% in the urban area and 42.2% in the rural area for their study carried out among women in Najaf Province, Iraq.

This high prevalence noticed in the urban area of the study population could be due to the low level of awareness of the disease there or possible reasons could also be the fact they have multiple sexual partners with a high rate of sexual promiscuity.

In the present study, females were more infected (19.8%) than males (5.8%). This finding is in line with those of Poole and McClelland (2013) who recorded that, males had an estimated prevalence that is 1/10th that of females in the study Global epidemiology of *Trichomonas vaginalis*. The result in the present study could be so because the female genital tract is more open than that of males. Also, it could be because of the iron rich component in menstruating women which alters the pH of the vagina which can lead to a greater burden of persistent *T. vaginalis* among women compared to men (Poole and McClelland, 2013).

The females in the present study were divided into pregnant and non-pregnant women. Hence among the females, the non-pregnant women had a higher prevalence of 29.8% as compared to the pregnant women who had a prevalence of 5.8%. Similar findings were observed by Nouraddin and Alsakee (2015) among 440 women in Erbil Governate, Northern Iraq who recorded that the infectious rate in non-pregnant women (3.4%) was higher than that found in pregnant women (0.0%). Also, the findings fall in line with those of Al-majidii and Alsaady (2020) who had 81.11% incident rate (IR) among non-pregnant women and a 78.57% IR among pregnant women in a study carried out in Maysan Province, Iraq. However, the finding of the present study disagrees with those of Gatti et al. (2017) who recorded that the prevalence of *T. vaginalis* infection among non-pregnant women (1.4%) treated at the university hospital in Southern Brazil was lower than those observed in other studies. Again, the prevalence among non-pregnant women in the study was higher than that of Onyido et al. (2014) who had a prevalence of 16.3% among non-pregnant women and a prevalence of 0.0% among pregnant women in South Eastern Nigeria. The infection could have been higher among non-pregnant women

than pregnant women in the present study maybe because during ANC (antenatal clinic), pregnant women are educated on so many diseases which could cause premature delivery or cause child deformation during pregnancy hence they know how to prevent themselves from getting the diseases.

The study showed that patients in the age group 17-25 years had a higher prevalence (19.7%) than other age groups, followed by ages 26-34 (18.9%), 35-43 (12.7%). In contrast, no *T. vaginalis* was detected in people from the age group 44-53 years and one person was infected in the age group 53 and above (5.6%). The result goes in line with those of Nouraddin and Alsakee (2015) who recorded that, women from age 16-26 years old had a higher prevalence of 4.0% followed by ages ranged 27-37 (3.3%) and 38-48 years old (3.1%). Also in their study, no *T. vaginalis* was detected in women who were above 49 years of age.

Furthermore, the result also agrees with those of Mazigo et al. (2016) who had a higher prevalence in the age group 15-25 years (24.7%) and the lowest prevalence in the age group 36-46 years (12.7%) in the study among pregnant women attending public antenatal clinics in Mwanza city, North-Western Tanzania. The findings of the present study disagree with that of Dickson et al. (2015) with the highest prevalence of 100.0% in the age group 26-40 years and the lowest in the age group < 25 years in the study among women attending the Yaounde University Teaching Hospital. Also, it disagrees with those of Al-Majidii and Alsaady (2020) who had 34-40 years age group as the highest prevalence (86.93%) and the lowest was 37.5% at less < 15 years age group. The prevalence of infection was higher in participants of the age group 17-27 years in the present study maybe because they are the most sexually active age group.

Regarding the level of education, those who were illiterates had the highest prevalence of *T. vaginalis* of 31.4%, while those in the primary level had the lowest prevalence of 12.9%. This finding is in the same direction with that of Watson et al. (2000), who in a study of rural men in

Tanzania observed that illiterates had a prevalence of 15.8% as compared to those in the secondary level of education with 7.4%, and university level with 8.7%. Also, the finding falls in line with those of Al-Majidii and Alsaady (2020) who recorded that, illiterates had a prevalence of 77.67% greater than those at the secondary level with the lowest prevalence of 50%, in a study amongst women in Iraq. The findings of this study disagree with the findings of Taher and Shaker (2018), which had the highest prevalence of 45% in those of the primary level and lowest in those of the secondary level with 20.5%, studied amongst women in the Najaf Province of India. In addition, the results of the present study also disagree with the findings of Mazigo et al. (2016) who recorded a prevalence of 23.2% in literates and 21.2% in illiterates in a study from Nwara City, North-Western Tanzania. Prevalence being higher in those who are illiterate maybe because of the low level of understanding of the availability and transmission of the disease.

Singles had a prevalence of 18.0% as compared to 15.0% of the married respondents. Married men were more infected with *T. vaginalis* (7.7%), than single men with 4.3%, and this finding agrees with (Watson et al., 2000), who recorded a 13.4% prevalence in married men and 6.9% prevalence in single men in a study carried out among men in Mwanza, Tanzania. The findings disagree with those of Onyido (2014), who recorded 20.9% for married people and 8.82% for singles. Singles were more infected in the study maybe because they are more excited about life and could be more promiscuous than the married persons. Single women had a higher prevalence of 26.7% than married women with a prevalence of 6.9%. This result disagrees with Al-Majidii and Alsaady (2020), who had an incident rate of 80.92% for married women and 40.62% for single women. Single women had a higher prevalence than the married women maybe because most of them were promiscuous.

Concerning occupation, sex workers had the highest prevalence of 40% and those working in offices with the lowest prevalence

of 13.3%. The finding falls in line with that of Watson et al. (2000), who recorded that the unskilled had a prevalence of 21.4% and the employed had a prevalence of 3.6%. The result contradicts that of Ton Nu et al. (2015), who reported that people employed had the highest prevalence of 24.1% while those unemployed had the lowest prevalence of 19.4%. In the present study, sex workers had the highest prevalence because they were exposed to multiple sexual partners.

Risk factors such as the sharing of fomites (towel, toothbrush, dresses) bathing together using the same bucket and having multiple sexual partners, cleaning of the toilet, usage of condoms during sex were found to greatly contribute to the prevalence of trichomoniasis in the urban than in the rural area. The findings in this study are in line with those of Verteramo et al. (2008). This could probably be because of the different habits of the patients in the different hospitals since they come from different areas. With respect to risk factors, there was a strong positive correlation with prevalence which meant that as the number of sexual partners increased, the prevalence increased greatly while as how often the patients cleaned their toilets reduced, the prevalence increased a little. When the use of condoms reduced, the prevalence increased very little indicating that significant was very minute.

Conclusion

Trichomonas vaginalis infection was prevalent among patients attending Providence Polyclinic (urban) and Balikumbat District Hospital (rural). The highest prevalence of infection was recorded in the urban area. Most of the infected patients were females, and the non-pregnant women were more infected than the pregnant ones. Patients in the age group 17 to 25 years had the highest prevalence of trichomoniasis. Single people had a higher prevalence than the married for the disease. Many more females were mostly diagnosed of *T. vaginalis* than men. The occurrence of the disease was found to be associated with having multiple sexual partners, no use of condoms during sexual intercourse and lack of hygiene. Although

STDs in general disproportionately concentrate in larger cities which receive all the health benefits, rural populations should not be excluded as these infections are also present in rural areas.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

EEJE, NONN and THK conceived and designed the study. EEJE, KL and THK collected and analysed the data. All authors wrote and approved the manuscript.

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